eunix: echo

Eric Bailey

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A reimplementation of `echo` for my own edification.

Headers and Forward Declarations

Include the core input and output functions from the C standard library.

1a ⟨* 1a⟩≡
```
#include <stdio.h>
```
This definition is continued in chunks 1 and 3e.
Root chunk (not used in this document).

Describe GNU `getopt`

1b ⟨* 1a⟩+≡
```
#include <getopt.h>
```

Declare the `usage` function.

1c ⟨* 1a⟩+≡
```
void usage();
```

Uses `usage` 3e.

The `main` Function

1d ⟨* 1a⟩+≡
```
int main(int argc, char *argv[])
{
    ⟨Process given options. 2d⟩

    ⟨Print each string, separated by a space. 3d⟩

    ⟨Print a newline unless the -n option was given. 2b⟩

    return 0;
}
```

Defines:
`main`, never used.

Processing Options

Currently, the ⟨*legal options* 2a⟩ are:

- `-n` (do not print a trailing newline)

2a ⟨*legal options* 2a⟩≡
```
n
```
This code is used in chunk 3a.

`-n` (do not print a trailing newline)

Declare a variable `newline_flag` to determine whether or not to print a newline after printing the rest of the given strings, i.e.

2b ⟨*Print a newline unless the* `-n` *option was given.* 2b⟩≡
```
if (newline_flag)
    putchar('\n');
```
This code is used in chunk 1d.
Uses `newline_flag` 2d.

When the `-n` option is given, set `newline_flag` to `0`, thereby disabling the printing of the trailing newline.

2c ⟨*Handle* `-n`. 2c⟩≡
```
case 'n':
    newline_flag = 0;
    break;
```
This code is used in chunk 2e.
Uses `newline_flag` 2d.

By default, print a trailing newline.

2d ⟨*Process given options.* 2d⟩≡
```
/* Flag set by '-n'. */
int newline_flag = 1;
```

This definition is continued in chunk 2e.
This code is used in chunk 1d.
Defines:
`newline_flag`, used in chunk 2.

Looping Through Given Options

2e ⟨*Process given options.* 2d⟩+≡
```
int c;

while (⟨Process each option until EOF. 3a⟩) {
    switch (c) {
    ⟨Handle -n. 2c⟩
    ⟨Handle illegal options. 3b⟩
    }
}
```
This code is used in chunk 1d.
Defines:
`c`, used in chunk 3a.

Describe this, esp. `getopt`

3a ⟨*Process each option until* EOF. 3a⟩≡
```
(c = getopt(argc, argv, "⟨legal options 2a⟩")) != EOF
```
This code is used in chunk 2e.
Uses c 2e.

If the user gives an illegal option, i.e. one not included in the ⟨*legal options* 2a⟩, display the usage information and return a non-zero status code.

3b ⟨*Handle illegal options.* 3b⟩≡
```
case '?':
    usage();
    return 1;
```
This code is used in chunk 2e.
Uses usage 3e.

Echoing Strings

Otherwise, loop through the remainder of argv and print each string, followed by a space. Unless the current string is the last one, i.e. index == argc - 1, in which case, do **not** print a space.

3c ⟨*Write a space unless this is the last string.* 3c⟩≡
```
if (index < argc - 1)
    putchar(' ');
```
This code is used in chunk 3d.
Uses index 3d.

Describe `optind`

3d ⟨*Print each string, separated by a space.* 3d⟩≡
```
int index;

for (index = optind; index < argc; index++) {
    printf("%s", argv[index]);
    ⟨Write a space unless this is the last string. 3c⟩
}
```
This code is used in chunk 1d.
Defines:
index, used in chunk 3c.

The usage *Function*

Display information on how to use echo, including ⟨*legal options* 2a⟩.

3e ⟨* 1a⟩+≡
```
void usage()
{
    printf("Usage: echo [-n] [string ...]\n");
}
```
Defines:
usage, used in chunks 1c and 3b.

To-Do